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Aspirin Loaded Poly-L-Lactic Acid Nanofibers and Their Potentials as Small Diameter Vascular Grafts

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Abstract : Among various approaches used for the treatment of cardiovascular diseases, the occlusion of the small-diameter vascular graft (SDVG) is still an unresolved problem which seeks further research to address them. Though autografts are now the gold standards to be replaced for blocked coronary arteries, they suffer from inadequate quality and quantity. On the other hand, the major problems of the tissue engineered grafts are thrombosis and intimal hyperplasia. Provision of a suitable spatiotemporal release pattern of anticoagulant agents such as heparin and aspirin can be a step forward to overcome such issues . Herein, we fabricated electrospun scaffolds from FDA (Food and Drug Administration) approved poly-L-lactic acid (PLLA) with aspirin loaded into the nanofibers. Also, we surface coated the scaffolds with Amniotic Membrane lysate as a source for natural elastic polymers and a mimic of endothelial basement membrane. The scaffolds were characterized thoroughly structurally and mechanically for their morphology, fiber orientation, tensile strength, hydrophilicity, cytotoxicity, aspirin release and cell attachment support. According to the scanning electron microscopy (SEM) images, the size of fibers ranged from 250 to 500 nm. The scaffolds showed appropriate tensile strength expected for vascular grafts. Cellular attachment, growth, and infiltration were proved using SEM and MTT (3-(4,5-Dimethylthiazol-2-Yl)-2,5-Diphenyltetrazolium Bromide) assay. Drug-loaded scaffolds showed a sustained release profile of aspirin in 7 days. An enhanced cytocompatibility was observed in AM-coated electrospun PLLA fibers compared to uncoated scaffolds. Our results together indicated that AM lysate coated ASA releasing scaffolds have promising potentials for development of a biocompatible SDVG.

Keywords : vascular tissue engineering, vascular grafts, anticoagulant agent, aspirin, amniotic membrane
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